State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

STATUS OF THE SPAWNING BIOMASS OF THE PACIFIC SARDINE, 1981-82

by

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MARINE RESOURCES

Administrative Report No. 82-1

January 1982

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ABSTRACT

State law requires that the population of Pacific sardines, *Sardinops sagax caeruleus*, must reach a minimum spawning biomass of 20,000 short tons before initiation of a fishery. Data from ichthyoplankton surveys, the anchovy live bait fishery, sea survey cruises, the mackerel purse seine fishery, and a brown pelican food study are discussed concerning evidence of an increase in population size. The spawning biomass of the northern stock of sardines appears to be remaining well below 20,000 tons.

1/ Marine Resources Region, Administrative Report 82-1

2/ Marine Resources Region, California State Fisheries Laboratory, 350 Golden Shore, Long Beach, California 90802.

STATUS OF THE SPAWNING BIOMASS OF THE PACIFIC SARDINE, 1981-82

RECOMMENDATIONS

As of January 1982, the spawning population of the northern stock of Pacific sardines, *Sardinops sagax caeruleus*, remains below the 20,000 short tons required to initiate a harvest. The Department recommends that restrictions concerning incidental catches remain in force and that no fishery be initiated during 1982.

INTRODUCTION

This is the eighth in a series of reports concerning the status of the sardine spawning biomass. It is similar to previous reports in that rather than attempting to estimate biomass, the author discusses several independent sources of data as they may relate to possible increases or decreases in biomass.

ICHTHYOPLANKTON DATA

Planktonic sardine larvae have been "routinely" sampled since the early 1950's by agencies participating in the California Cooperative Oceanic Fisheries Investigations (CalCOFI) egg and larval surveys. These surveys were conducted annually until 1966. Since 1966, complete surveys have been conducted every three years (1969, 1972, 1975, 1978 and 1981). In 1979 and 1980 partial, modified surveys were conducted for the purpose of estimating northern anchovy, *Engraulis mordax*, spawning biomass.

Smith (1972) provided a regression estimate to derive sardine spawner biomass estimates from the regional census estimates of total sardine larvae. This resulted in a spawning biomass estimate of 27,000 tons for 1969 based upon larval counts which were only 75 percent complete. At least 50% of this estimate was contributed by the southern stock. Although calculated estimates of sardine spawning biomass for subsequent survey years have not been published, the relatively few larvae collected in 1972, 1975 and 1978 (Paul Smith, NMFS,

La Jolla, pers. commun.) suggest the biomass remained at extremely low levels during the 1970's.

Although most of the 1981 survey data remains unprocessed, information from the first five survey cruises, covering approximately the first half of the year, was provided by National Marine Fisheries Service (NMFS, La Jolla) personnel. There were 11 positive plankton tow stations for sardine eggs and 13 for larvae during these cruises. These positive stations ranged from off Point Conception to approximately 100 miles south of Ensenada, B.C., with "small" clusters of positive stations occurring roughly near Point Mugu, Santa Monica Bay, Punta Colnett and Cabo San Quentin. All but one of the positive stations occurred in "nearshore" waters (roughly within 25 miles of shore).

Comparatively, these data represent an increase, over the survey years of the 1970's, in the number and geographic range of positive stations, and the numbers of eggs and larvae sampled. At face value, these data suggest a moderate increase in spawning biomass in recent years.

LIVE BAIT FISHERY

Klingbeil (1976) briefly describes the nature of historical data collection from the southern California live bait fishery. This fishery operates primarily in nearshore waters from San Diego to Morro Bay, and sardines are sometimes caught incidental to fishing for northern anchovies. Fishermen submit monthly logs to the Department on which they are asked to indicate the frequency of occurrence of incidental catches of juvenile sardines.

The "occurrence" of sardines in live bait catches during 1981 was less widespread than the previous year. In 1980, juveniles were reported in catches at almost every port from San Diego to Avila, but were only a common occurrence in quantities greater than trace amounts at San Diego. During 1981, sardines were only reported by San Diego, Oceanside, Dana Point, Newport Beach, and Long Beach fishermen but the frequency of occurrence was higher than in 1980 at

every port except San Diego.

Juvenile sardines were reported for 36 percent of the fishing days at San Diego in 1981 compared to 45 percent in 1980. Although fishermen at the other ports reported sardines less frequently (less than 10 percent of the days fished at Oceanside, Dana Point, Newport and Long Beach), some of their catches consisted of sardines in greater than trace quantities. Long Beach fishermen reported dumping a 12-ton and a 5-ton catch on successive nights of fishing in October. During the spring, a Dana Point fisherman indicated (verbal report) he had several catches in which sardines made up 5-10 percent of the catch. San Diego fishermen also reported having to dump sets on straight sardine schools.

Both the frequency of occurrence and the quantities of sardines reported by live bait fishermen seem to have taken a gradual upturn the last 2 years, which may be indicative of a relative increase in biomass.

SEA SURVEY CRUISES

The Department has conducted five intensive, nearshore, mid-water trawl surveys off northern Baja California and southern California in recent years (1976, 1977, 1979, 1980 and 1981). The objective was to assess the young-of-the-year of anchovy; sardine; Pacific mackerel, *Scomber japonicus*; jack mackerel, *Trachurus symmetricus*. During the 1976, 1977, and 1979 cruises, juvenile sardines were sampled in 2.8, 2.5 and 2.3 percent of mid-water trawls, respectively. In actual numbers, only eight sardines were taken in seven of the 283 trawl stations. The 1980 and 1981 surveys were even less productive; no sardines were sampled by the 2-year total of 282 mid-water trawls.

In 1981, an additional mid-water trawl survey was added to the cruise schedule late in the year. This survey was an attempt to sample young-of-the-year of the above species in "offshore" areas over the basins in the Southern California Bight. Of 119 trawl stations, three juvenile sardines (97-132 mm SL) were collected at only one station which was located off Santa Catalina Island.

Increases in biomass suggested by live bait and egg and larval survey data are not substantiated by the continuing low levels of recruitment suggested by the young fish mid-water trawl surveys.

MACKEREL FISHERY

During 1981 the quantity of sardines landed incidentally with mackerel decreased from the 37.6 tons estimated for 1980 (Addendum 1), although sardines were sampled from landings in all but 2 months during the year. The estimated 31.0 tons landed (Addendum 2) is still significantly higher than what was landed in any other year since the fishing moratorium took affect in 1974.

Length frequencies produced from sampling these incidental catches suggest that the 1981 spawning year may have been relatively more successful than any in the last decade or so. The 1981 year class, ranging in size from 75-140 mm SL, was sampled several times during the late fall.

BROWN PELICAN FOOD STUDY

Since 1978, Department personnel have been studying the diet of the brown pelican, *Pelecanus occidentalis californicus*, by examination of chick regurgitation for fish otoliths. Sampling has been conducted at both Anacapa Island and the Los Coronados.

While anchovies appear to be the dominant food item, many other fish, including Pacific mackerel, *Scomber japonicus*, contribute to the diet. In 4 years of sampling, no sardine otoliths have been detected (Paul Kelley, DF&G, pers. commun.). It seems logical that a major resurgence of sardines, fish that are known to often school on or near the surface, would result in an increased pelican-induced mortality.

The results of the food studies suggest that if the sardine biomass has increased in recent years, this increase has been relatively small.

OTHER INFORMATION

The most optimistic "signs" of an impending resurgence of sardines came

from increasing reports by fishermen of sightings, sets, and dumping of "pure" schools of sardines during the summer and fall of 1981. Almost all of these reports are unconfirmed. However, in one instance, the fisherman who reported dumping 50 tons of sardines in the vicinity of Point Dume, provided the port sampler with an approximate 5-pound sample of sardines. All these sardines were fish-of-the-year (1981 year class).

DISCUSSION AND CONCLUSIONS

Data from the brown pelican food study and sea survey cruises point to a continuing low level of recruitment to the spawning population of sardines. Live bait and mackerel fishery data suggest the biomass in the early 1980's may be fluctuating at levels slightly above the extremely low levels of the 1970's. Icthyoplankton data for 1981 also suggests a moderate increase in biomass. An apparent increase in availability of sardines on the fishing grounds has led some fishermen and fish dealers to inquire about relaxing market restrictions and increasing the allowable tolerance of sardines caught incidentally with other species.

None of this information is interpreted as suggesting a "major" resurgence of sardines is occurring. The most optimistic statement might be that a resurgence is possible if trends continue. If the latter is true, the recovery will be hastened by strict observance of the moratorium, the tolerance levels for incidental catches, and the marketing restrictions.

REFERENCES

Klingbeil, Richard A. 1976. Status of the spawning biomass of Pacific sardine, 1975-76. Calif. Dept. Fish and Game, Mar. Resour. Adm. Rept. 76-4:1-9.

Smith, Paul E. 1972. The increase of the spawning biomass of northern anchovy, *Engraulis mordax*, U.S. Nat. Mar. Fish. Serv., Fish. Bull. 70(3): 849-874.

ADDENDUM 1. Estimated Species Composition by Weight (short tons) of Southern California "Mackerel" Landings, 1980 1/

Month	Total tonnage landed	Proportion of tonnage sampled for species composition 2/	Estimated landings 3/ Jack mackerel	Pacific mackerel	Pacific sardines
January	7,799.7	0.66	2,643.1	5,156.6	-
February	2,570.8	0.53	809.8	1,761.0	-
March	1,910.9	0.39	468.2	1,442.7	Trace
April	3,328.8	0.47	842.2	2,486.6	Trace
May	4,573.3	0.58	1,273.7	3,295.8	3.8
June	747.1	0.08	612.1	135.0	Trace
July	10,678.4	0.62	3,327.4	7,336.1	14.9
August	7,050.7	0.75	1,900.2	5,147.7	2.8
September	5,522.5	0.68	2,201.6	3,305.7	15.2
October	4,278.6	0.59	3,430.5	847.2	0.9
November	1,846.7	0.35	1,466.3	380.4	Trace
December	4,303.9	0.62	3,249.4	1,054.5	Trace
Totals	54,611.4		22,224.5	32,349.3	37.6

1/ Includes landings at Terminal Island, San Pedro, Port Hueneme, and Monterey.

2/ The majority of sampling consisted of taking "bucket" samples during the off-loading process. A portion of the tonnage sampled includes "eyeball" estimates of species composition.

3/ Estimated landings result from applying simple monthly proportions of the species composition of sampled landings to the total tonnage landed.

ADDENDUM 2. Estimated Species Composition by Weight (short tons) of Southern California "Mackerel" Landings, 1981 1/

Month	Total tonnage landed	Proportion of tonnage sampled for species composition 2/	Estimated landings 3/ Jack mackerel	Pacific mackerel	Pacific sardines
January	2,350.1	0.35	1,360.0	990.1	-
February	7,700.4	0.62	1,821.9	5,866.2	12.3
March	5,208.6	0.52	3,182.0	2,025.6	1.0
April	5,667.1	0.65	3,326.6	2,340.5	Trace
May	2,309.9	0.45	1,005.7	1,304.0	0.2
June	348.3	0.29	191.3	157.0	-
July	4,247.8	0.55	884.4	3,362.2	1.2
August	10,946.0	0.65	832.1	10,111.9	2.0
September	5,725.1	0.69	629.2	5,091.4	4.5
October	3,166.7	0.73	257.1	2,908.7	0.9
November	5,126.4	0.86	739.6	4,380.9	5.9
December 4/	5,220.3	0.66	1,278.9	3,938.4	3.0
Totals 4/	58,016.7		15,516.7	42,476.9	31.0

1/ Includes landings at Terminal Island, San Pedro, Port Hueneme, and Monterey.

2/ The majority of sampling consisted of taking "bucket" samples during the off-loading process. A portion of the tonnage sampled includes "eyeball" estimates of species composition.

3/ Estimated landings result from applying simple monthly proportions of the species composition of sampled landings to the total tonnage landed.

4/ Preliminary.